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A Note on the Tractor Trials held at Nagpur from the 18th to the 21st February 1920

BY

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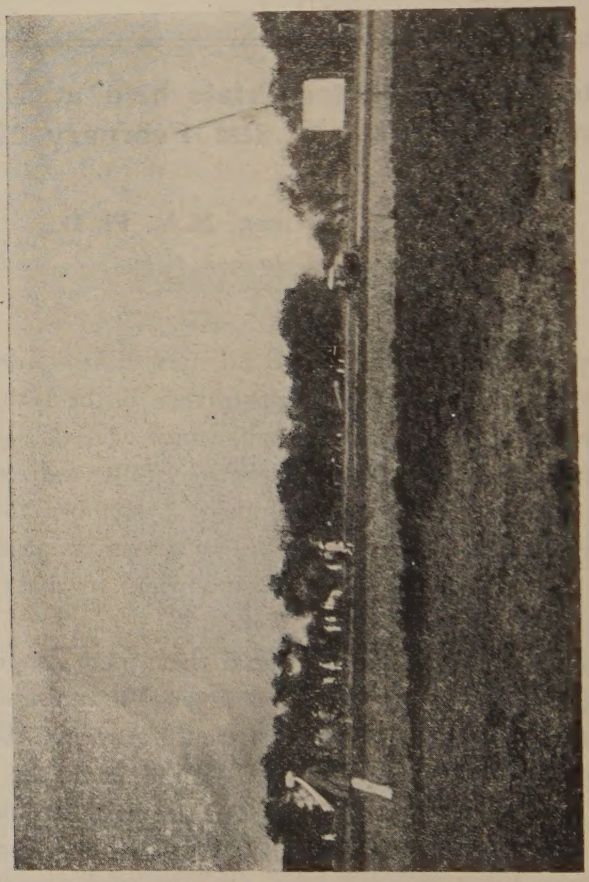
THE Tractor trials at Nagpur which were to have commenced on the 16th February were postponed till the 18th to allow for the arrival of tractors and ploughs which were delayed on the way. The 16th and 17th were, however, fully utilized by the judging Committee of which I was made a member to prepare the scheme of trials, to arrange as full a series of questions as possible and for the engineering members to make as full examination of the Tractors as possible.

Although it had been anticipated that there would be at least eleven types of Tractors competing at the trials as a matter of fact only five appeared. These were the Austin (British), the Fiat (Italian), the Fordson, the Cletrac and the Lauson (American). Of these, the Lauson and the Fiat are distinctly heavier and higher powered machines than the other three. It is unnecessary to go into the structural details of these machines or

the detailed results of the trials here as they will be published later in the report of the Committee. I shall confine my remarks to more general matters.

The actual tests were four in number. Of these, three were ploughing tests and the fourth was a belt test *i.e.*, a test of the suitability of the Tractors for running machinery. The actual machinery run were (*a*) a small sugar-cane mill, (*b*) two Platt double-roller gins, (*c*) a fodder cutter, and (*d*) a threshing machine. These were all run off a common shafting, the horse power required for running all the machines combined being estimated at 16 H.P.

I shall deal separately with the individual tests. Ploughing Test No. 1 was a 4-hour reliability test in which Tractors had to



General view of one of the fields used for the competition. The Fordson is to be seen towards the right of the picture.

plough for a continuous period of four hours. The soil was a medium black cotton one but was of course very hard. Account was kept of the number of stops and their causes, the area ploughed and the fuel consumption. The Austin was the most economical Tractor in this and turned out the most work of any. The quality of the work was however not so good as that of either the Fiat or the Lauson. The Fordson did work decidedly inferior to the other Tractors in this trial. In this as in all the ploughing trials it showed itself as a distinctly dangerous machine, it being inclined to rear up in the air owing to faulty distribution of weight. The Cletrac was unable to compete owing to plough breakage.

Test No. 2 was a 1-acre time test, *i.e.*, each Tractor had to plough one acre of land, the time taken being recorded. The soil was much the same as in the first test. In this test the Fiat did distinctly the best while the Fordson did better than the Austin which lost heavily on account of poor quality of work. It may be pointed out here that the Fordson had a much better plough fitted to it than the Austin had. In fact the plough used with it seemed to be the one best adapted to the soil conditions at Nagpur of any exhibited there.

Test No. 3 was a 1-hour area test on heavy black cotton soil. This soil was distinctly heavier than any I have seen in Mysore and, as it was very hard, was an extremely severe test. On this land much the best work was done by the Fiat which, considering the character of the soil, gave a very creditable performance. The other heavy Tractor, the Lauson, did fairly well but this Tractor both here and in the other tests was badly handled and showed itself a heavy consumer of fuel.

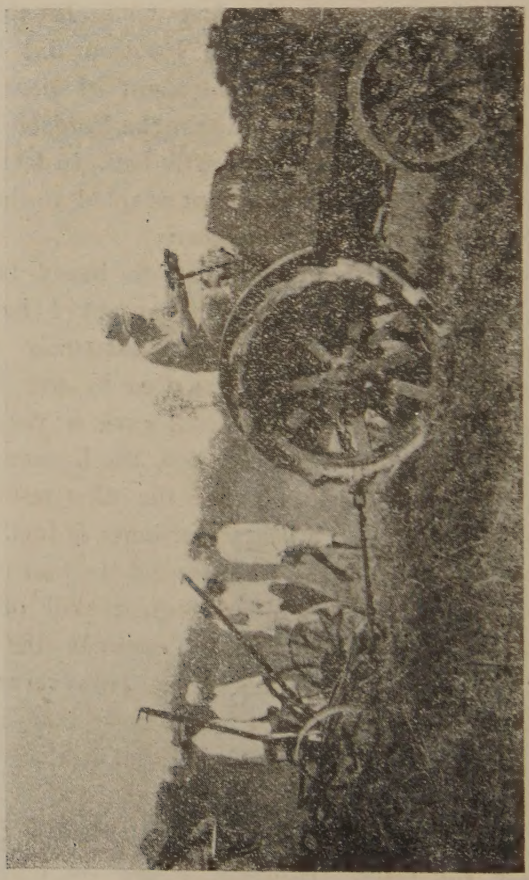
Of the light Tractors the Fordson did the best in this test, thanks to its superior plough and the great skill of its driver. The Austin was the most economical Tractor in the test doing one-fourth acre on $5\frac{1}{2}$ pints of kerosene. However its ploughing was not sufficiently deep. The Cletrac both here and in the other tests showed itself as geared too high so that it travelled much too fast to do good work.

I was not present for the whole of the belt test as I had to leave to catch the train. However I saw the Fiat, the Austin

and the Fordson working and have no hesitancy in saying that the Austin showed itself decidedly superior to the other two on this class of work. The Fordson could not work the whole series of machines satisfactorily while the Austin had not the slightest trouble. The Austin has a very efficient governor which keeps the running steady under variable loads. The Fordson has no governor at all and must be controlled from the throttle,—a very unsatisfactory arrangement. While the Fiat has a governor this was not acting properly probably because of faulty adjustment.

The following are my impressions with regard to the individual Tractors :—

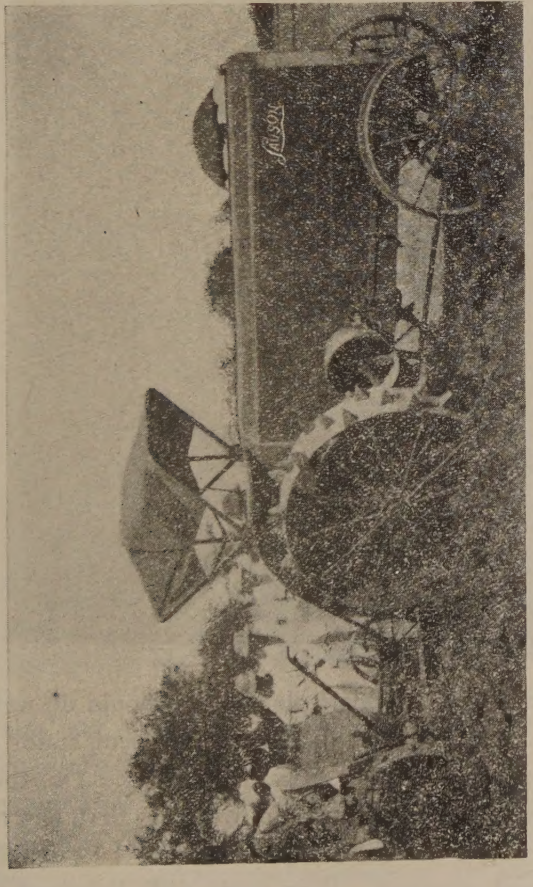
1. Fiat.—(Approximate cost Rs. 6,500). A fairly heavy



The Fiat Tractor ploughing in medium black cotton soil.

Tractor which did satisfactory work throughout. It was fairly economical of fuel and moderately handy in turning. It is not as well balanced as it should be and showed a tendency to rear up in heavy going. The strakes provided for the hind wheels were not very efficient in preventing slipping. It did fairly satisfactory belt work but was not properly governed. It has only one brake working through the differential. This is not as satisfactory for road work as are brakes acting on the rear wheels. It has no springs in the rear and would hardly be suitable for road haulage. I think a more highly powered machine is required for heavy black cotton soil.

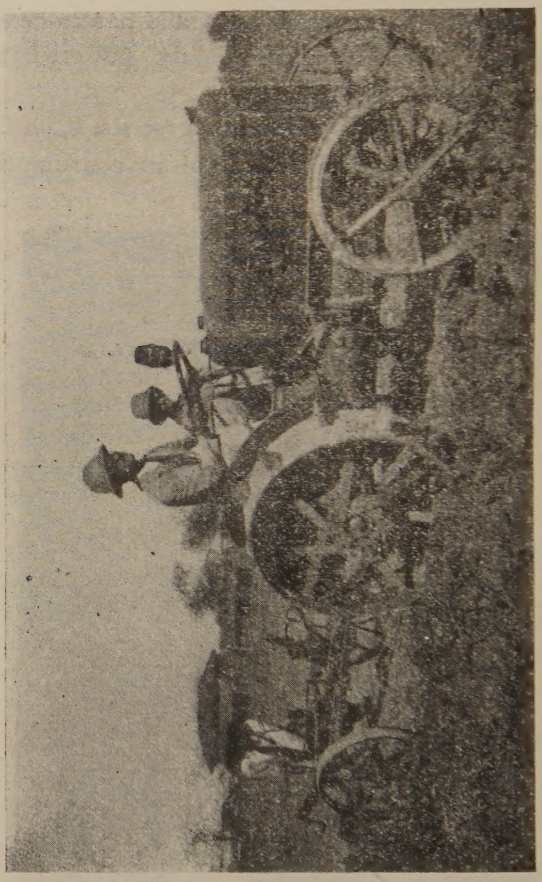
2. The Lauson.—(Approximate cost Rs. 6,500). A heavy Tractor with ample power but wasteful in consumption of both



The Lauson in the hour test, stopped on account of plough trouble.

lubricating oil and fuel (this may have been partly the fault of the driver). The work done by it was only fairly satisfactory but it was handicapped by a poor driver. I did not see it tested on the belt.

3. The Austin.—(Approximate cost Rs. 3,500). A comparatively light Tractor capable of doing good work on medium and light soil but not suitable for work on black cotton soil

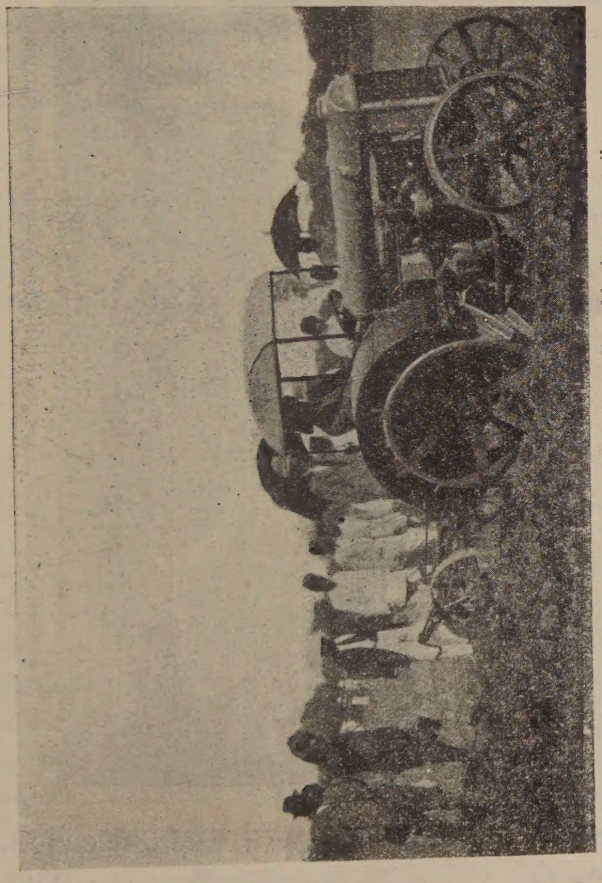


The Austin Tractor in the hour test. Note the large spuds in the hind wheels.

except perhaps with a single plough. It should do well on sugarcane land. It is provided with very efficient spuds on the rear wheels which practically prevent slipping. On the whole it showed itself more economical in running than any of the other Tractors. It did excellent belt work, thanks to the efficiency of its engine and governor. It is quite well balanced and showed

only a very slight tendency to rear up. It has two independently controlled brakes working on the two hind wheels. It has no springing in the rear but as it is provided with large rubber pads for road work might prove fairly satisfactory for road haulage.

4. The Fordson.—(Approximate cost Rs. 3,500). A light Tractor capable of doing good work on medium and light soils but unsafe in the hands of any but a skilful driver owing to its

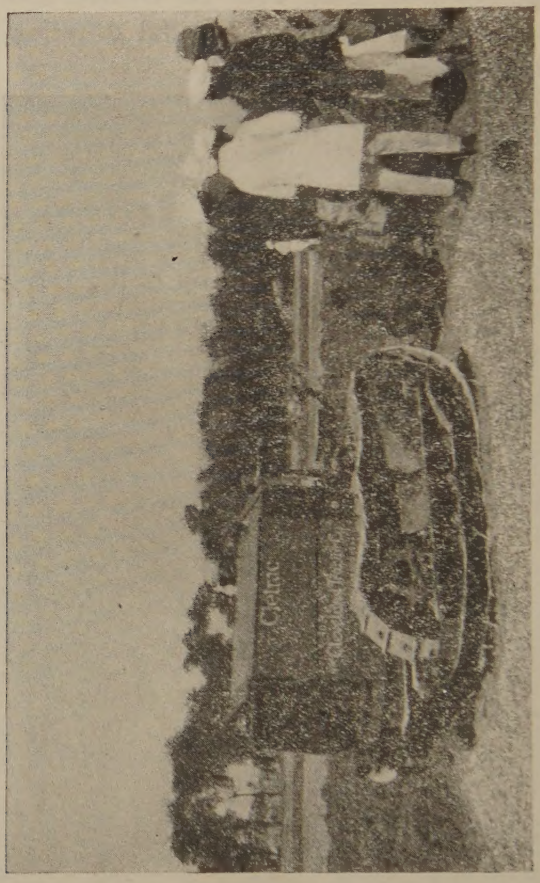


The Fordson Tractor working in medium black cotton oil.

bad balance and tendency to rear up. Quite unsuitable for heavy soils. It is not as powerful as the Austin. The strakes on the rear wheel are not very efficient so there is considerable tendency to slip. It is not well adapted to belt work as it has no governor ; not suited for road haulage as it has no springs

either front or rear and no brakes. On the whole, it does not appear to be a particularly suitable Tractor for this country.

5. The Cletrac.—(Approximate cost Rs. 5,200) is a comparatively light Tractor with caterpillar tread. It is very handy in turning but has only a single forward speed which is too high for dry soil ploughing in India. Owing partly to its



The Cletrac in the hour test, stopped on account of plough trouble.

high speed the work turned out by it was very poor, decidedly poorer than that of any of the other Tractors. With a lower gearing which would allow for ploughing at a rate of two to two and a half miles an hour, this Tractor might prove a very useful one. Its cost is, however, high as compared with that of the other light Tractors exhibited. To what extent the question of wear on the exposed track of the Tractor will militate against its

introduction into India could only be decided after a trial extending over at least a year. The Madras Department of Agriculture have purchased one of these Tractors and should be able to give some useful information with regard to this point after more extended trials.

This Tractor was not tested for belt work during my presence at the trials but the position of the pulley is not a convenient one and is likely to lead to difficulty in getting the Tractor into alignment. The Tractor is sprung in front, not behind. The caterpillar tread does not appear to me suitable for road haulage in Mysore at least and the clearance of the Tractor is likely to be insufficient for this purpose.

THE INDIAN SUGAR COMMITTEE.

Summary of Evidence in the Mysore State, abstracted

BY

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Area under Cane.

ABOUT 4 per cent of the total irrigable area in the State is under cane. The small fluctuations in area that do occur, are chiefly due to the variations in the price of jaggery and in the availability of water for irrigation. An increase in the cane area is prevented by lack of water. Good prices and better methods of cultivation, resulting in better yields, would tend to an increase in the area under cane.

Varieties of Cane.

Pattapatti.—This is a soft, fairly thick, striped cane, containing about 19 per cent of sucrose and 5 per cent of glucose. It matures in 12 months and keeps uniform, without deterioration, for about 10 weeks. It tillers well, and readily responds to manure. It has a tendency to lodge, the upper part of the

cane being thicker than the lower, and is not drought-resistant in the least. It is attacked by borer, jackals, and pigs.

Rastali.—This is a soft, thick, white cane. It does not tiller well and is not a heavy yielder. It does not stand drought. It lodges and is attacked by borer, jackals, and pigs.

Cheni.—This is a hard, thin, reed cane, light coloured and with a bloom on it. This is drought-resistant and can be grown on alkaline soils. It tillers freely and yields a good tonnage. It is attacked by leaf fungi and smut.

Mysore Java.—A foreign, white, thick, fairly hard cane grown rather commonly in the Malnads. It yields a good coloured jaggery. It does not tiller well, flowers freely, and lodges badly. It is fairly drought-resistant.

Red Mauritius.—So far, this is the most vigorous and high yielding cane. It does not lodge, and is not attacked by jackals. It is a hard cane, and the jaggery produced is of a dark colour. It is badly attacked by borer.

Java 33-A.—A reddish reed cane, very similar to cheni and giving good results. Its cultivation is spreading.

Besides these a number of seedling canes have been raised on the Hebbal farm, and the best of these are being sent out into the districts.

Cultivation.

The most usual planting season is from January to March. Sometimes planting is done in September and October; but these canes are allowed to stand on the ground for from 14 to 18 months, whereas in the former case, the cane is harvested after 12 months.

Soil.—It is on paddy soil—a dark clayey or silty loam—that sugar-cane is usually grown. It can be grown on any soil, if there is a sufficient supply of water.

Preliminary cultivation.—Either ploughing or digging of the land is done. The iron plough is coming into more common use for ploughing cane lands. The clods are then crushed by hand with mallets, and the field is then levelled by the log harrow or large bullock hoe.

Planting.—The cane is planted either in the pits or furrows.

The furrows are about 1½ feet apart and the sets are planted in the furrows end to end. Pits are placed in squares 3 feet each way and two sets are planted in each pit. The pits are hand-watered till the cane is about two months old. Tops are most generally used for planting, but whole canes are also used. Both systems give good results.

After-cultivation.—This consists in weeding, digging, earthing up, and wrapping. Wrapping is done only on the thick canes and that more commonly in the eastern part of the State. Ridging and earthing up is most common in the western part of the State where heavy rain necessitates efficient drainage.

Ratooning.—This is practised generally in the Malnad tracts and rarely in other parts.

Rotation.—The main rotation is with paddy. Sugar-cane is usually grown in the midst of paddy plots and hence the drainage is very deficient. In some cases, garden crops like chillies, onions, and potatoes, and dry field crops like ragi, green-gram, and black-gram are grown as rotation crops.

Manuring.

Cattle manure is the most common, 10 to 60 cartloads being used per acre. Sheep manure (by folding) is also used, as well as tank silt, night-soil, and green manures. Oil cakes from one to three tons an acre are used on about 25 per cent of the cane area, the cakes used being Castor, Hongey, and Ground-nut. The department is popularising the use of cakes. The use of artificial fertilisers is unknown.

Irrigation.

Sugar-cane is irrigated chiefly from tanks. Canal and well irrigation are of minor importance. An increase in area can be expected under Marikanivé, Sulékeré, and Krishnarajasagara reservoirs. Installation of pumps have not so far been successful. Cane is little more than a rain-fed crop in the Malnads where the question of drainage is important. An assured supply of water would lead to an increase in the area under cane. No co-operative purchase of pumping plants has yet taken place in the State. Salinity of lands is not due to cane culti-

vation. On the other hand the substitution of paddy by sugar-cane may improve saline lands.

Pests and Diseases.

Moth Borers.—This is the most serious pest of sugar-cane. Measures calculated to reduce injury from borers are:—(1) Early planting—in January, (2) Using heaps of trash in the field as traps for the moth, and (3) Removal of alternate host plants. The first is the most important.

Smut (Ustilago Sacchari).—This does considerable damage to Cheni. It also attacks J. 33-A: but the thick canes are immune.

Red Rot (Colletotrichum Falcatum).—This appears only in places of defective drainage or insufficient water-supply.

Rusts and Leafspot diseases are almost entirely confined to Cheni.

Pigs and jackals attack only softer canes, not Cheni or Red Mauritius.

Manufacture.

The common three-roller mill gives 58 to 67 per cent of extraction. The "Nahan" mill gives 68 to 69 per cent and is very popular. The "Glasgow" power mill gives 72 to 78 per cent extraction and the Massey mill 70 to 72 per cent. Thus, the introduction of a suitable mill will tend to increase the returns from cane.

The round pan and the single furnace are usually used. Multiple furnaces have so far not shown any saving of fuel.

Sugar can be made directly from the juice with the ordinary methods of boiling but the percentage of recovery of sucrose is not large and the losses are great.

Small, complete power outfits are desirable, and Government should help in the starting of sugar-cane plantations.

Central Factories.

These can only be established in one or two isolated areas. The Marikanivé area with the high level channel completed, would allow of about 2,000 acres of cane, and 500 tons of cane per day could be supplied to a factory. The land has to be entirely under the control of the factory. Existing conditions

do not admit of large factories. Producing raw sugar and sending it on to refineries would include a double cost. Small factories using cane from about 100 acres could be started. Want of expert knowledge has gone against the production of sugar on an efficient and cheap basis. There is scope for small power mills on a co-operative basis in villages where there are more than 50 acres of cane grown.

Government assistance is necessary for the establishment of factories. A sugar-cane expert in the Imperial Department of Agriculture is desirable and his services should be at the disposal of all. A detailed survey of the State is essential.

Development.

Future development must be on the lines of improving indigenous methods. The jaggery market is not increasing. The establishment of factories on purchased land is desirable.

A Central Sugar-cane Experiment station should be maintained by the Government.

Duty on sugar, if imposed, should only be temporary.

Statistics must be collected. A Standing Committee should be appointed to deal with sugar-cane matters and the information gathered should be published once a quarter.

A survey of all the water power in the Malnad, the drainage of the Marikanivé tract and the extension of the Railway to Hiriyur, the introduction of better types of sugar-cane, and the opening up of colonies of agricultural students should be undertaken.

A conference of workers once in about three years is desirable.

The cultivation of the wild date (*Phoenix Sylvestris*), and Bhagani (*Cariota Urens*) as subsidiary sources of sugar may be considered.

The Cultivation of Paddy in the Tinnevelly District, South India.

By a Local Landlord.

THE cultivation of paddy described in the following account relates to the region of the valley of the river Tambraparni in the Tinnevelly District. *Paddy* is almost the only crop cultivated; and the agriculture of the tract concerns itself so completely with paddy that it will be quite possible to meet villagers who may never in their life have seen any field crop other than paddy. The cultivation is very intensive; two crops of paddy are raised in the year and where as in the village to which this description relates, the irrigation source is a river-fed tank a third crop is raised also if the water in the tank will at all permit of such. The soils are varied, the chief being alluvial loams: the soils are well manured and cared for. The yields are good considering that two successive crops are invariably raised in the year. The land value is extraordinarily high, ranging from Rs. 2,000 to 4,000 an acre and the Government assessment is also heavy being as high as Rs. 19 to 21 an acre.

The lands of this village depend for their irrigation upon a tank which is fed from a river channel. Freshes in the river arrive twice a year—once during the south-west monsoon and again during the north-east monsoon. Corresponding to these two seasons, there are two paddy-sowing seasons. The first season commences in the month of May and the crop sown in this month is harvested about the end of August. The variety sown in this season is a comparatively coarse variety, the husked grain being reddish in colour.

The method of cultivation is as follows:—

Immediately after the harvest of the previous crop, the land is ploughed once, a light watering being given prior to the ploughing to soften the soil. One week after this ploughing, a second ploughing is given in a puddle of ½ an inch of water, the plough is followed by the levelling board; manure which

consists of cattle manure and household ashes are carted at the rate of 20 cart-loads to the acre. Ploughing and levelling is repeated twice more at the same intervals so that all stubble and weeds rot and the soil itself is worked soft as butter. Bunds are trimmed, fresh weeds removed meanwhile, and the field is ready for sowing.

Seed is sprouted preparatory to sowing; this is accomplished in the following way :—Seed tied up and well packed in straw in wicker baskets is soaked under water for one night, the basket is taken out and left to drain for 12 hours; it is again kept under water for an hour, taken out, emptied loose into a heap; in about 12 hours again the seed shows sprouts uniformly and is ready for sowing. Immediately prior to sowing the land is given a final puddling with the plough, the levelling board following with a small bundle of straw tied to it, which makes a shallow drain at regular intervals. Seed is sown in the puddle broadcast, the seed rate being 5½ seers of seed paddy per acre. The following day, the field is drained and left in this condition for five days, when young green sprouts appear. The watering of the young crop is done very carefully. One watering is given on the 5th day and the field drained the same evening; watering is likewise given on the 7th and 9th days also, the land being drained on 8th and 10th days. From the 11th day onwards water is let in so that about 2 inch depth is always maintained. About the 20th day, the field is weeded and on the 30th day all uneven stand is rectified, blanks being filled and thick patches thinned. Irrigation is meanwhile continued uninterrupted till when the heads begin to show, the field is drained for a couple of days to "make the soil firm" as they say. A week before harvest, the field is drained completely. The yield of paddy per acre in this season ranges from 900 to 1,200 Madras measures.

The second main crop is sown in the month of September or more often in the month of November. If sown in the latter month cultivation is similar in all respects to that described already, *i.e.*, the seed is sprouted and sown broadcast; if it is in September, then the crop is transplanted. In both cases however a finer variety of paddy is sown and not the coarse variety sown in the first main season. The yield however is

not so high, being only about 1,000 Madras measures. The seed per acre when transplanting is adopted is about 20 Madras measures. Transplanting in single seedlings is slowly coming into practice; this effects a great saving in seed. All varieties however do not do well when planted single, nor is the discouraging appearance of the single seedling crop in its earlier stages any indication that the yield would be poor; on the other hand some varieties yield more by this method.

It sometimes happens that the sowing season is delayed for this crop, the field dries hard during the interval. In such circumstances, the field is ploughed in puddle four times in the same day and sown immediately after. A higher yield of paddy is obtained, *i.e.*, about 1,200 measures per acre, and this is put down to the beneficial effect of the drying. The sowing time is however not left to one's choice but is fixed by the time the tank gets its supply of water.

In some years it happens that there is a sufficient supply of water for a third crop of paddy. For this purpose a coarse early maturing paddy which matures in about 70 to 90 days is used, and of these there is more than one variety available in these parts.

As regards net returns to the owner the following will give some idea. Land is either leased out or the owner attends to all the cultivation with paid labour. In the former case from 1,100 to 1,400 Madras measures of paddy and about 10 bundles of straw (1 bundle may be taken to weigh 40 lbs.) are paid to the owner, who has no expense to bear except paying the assessment on the land. If as we see from the foregoing account the gross yield from the two crops amount to about 2,000 Madras measures of grain and some 100 bundles of straw, the proportion in which the produce is divided between owner and lessee can be easily calculated.

Where the owner conducts the cultivation himself, cooly wages are paid for ploughing, sowing, weeding, irrigation and watching; these are all done by the labourer on contract, the customary wage for all these operations being $\frac{1}{8}$ of the gross yield of grain and one half of the straw. Harvesting, threshing,

winnowing and filling into carts are paid extra, these are also done by contract, the wages being 224 Madras measures per acre.

The owner pays, in addition, for the manure the seed, and also as in the former case the assessment on the land. Reckoning the yield per acre as 2,000 Madras measures in an average year, the owner will get as his share under this system about 1,400 measures and about 50 bundles of straw, which is not very much more than what he could get if he had leased out his land.

Striga, a Vegetable Parasite on Jola and Ragi

BY

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STRIGA known as *bile kasa* is the common parasite that plays havoc on jola. It is found here and there on sugarcane. Lately *i.e.*, five or six years ago, it was discovered on ragi also in the semi-malnad parts of Shimoga. It is a herb belonging to the order *scrophulariaceae*. It exhibits itself in two forms, bearing white and yellow flowers. The white-flower type is the more conspicuous of the two while that with the yellow flower is found only where the rainfall is heavy or the land is water-logged. Occasionally grasses harbour striga and whether they can be taken for alternate host plants in the absence of ragi is a question that requires further sifting. The vigour of striga and its number in grassy turfs however do not indicate that it can flourish well on grasses.

Soils preferred.

Striga is so prevalent in black soil that it is aptly called the black-soil or jola parasite, though its presence is equally felt in the loamy or red soils of ragi. In loose sandy soils however, it is certainly less abundant.

Life History.

The shed seed begins to germinate about August or so after the host plants have attained some growth. The striga plant

soon begins to develop at the expense of the host and assumes a height of eight inches to a foot. It soon bears capsules that contain myriads of minute seeds which mature by about the end of October or early November. The seeds are jet black and look almost as fine as the grains of smut. The seeds are dehisced from the top of the capsule and are strewn all over the land. Here they rest until suitable host appears again.

That the striga seeds do not germinate under ordinary conditions like other seeds do is proved beyond all doubt. They absolutely need stimulus from the host plant. Striga plants are for instance totally absent in fallow lands in which they will have wrought evil during the previous ragi season. They likewise disappear when horsegram or any other non-host plant is on the land. How long the seeds remain dormant in the land is also a problem that requires further investigation. They do die by age and their percentage of germination diminishes materially from the third year. One year of horsegram after ragi does not improve matters much but two intervening crops lessen its ravages appreciably. Stray striga plants appear even in the fifth year and begin to rapidly increase in number if ragi is successively grown. Thus to avoid loss from striga, lands are taken up for temporary cultivation for one year wherever assessed waste land is found in plenty. They are relinquished the next year and allowed to lie fallow for four years. They are applied for again the fifth year and ragi is raised thereon.

I am not sure that striga seeds are carried from grass to arable land through the dung of cattle as Mr. Mollison says. While striga is raging in an area there are in the same village patches in which it is totally absent for years together. When there is a common grazing land in a village in which striga is prevalent, I am at a loss to see how land manured with the same lot of cattle manure should produce striga in one case and fail to do so in the other. Again Mr. Mollison says that it is carried by the host plants. This theory is obviously untenable at least in the case of jola or ragi as striga is propagated only by means of seeds.

There is some chance of striga seeds getting mixed with the grains of ragi or jola. This is however minimised to a large extent as long before either of these crops are harvested, the striga seeds will have dehisced and the plants themselves become dried and shrivelled. Striga is probably transported to a new place along with the seeds of ragi and jola.

The dehisced seed is carried short distances by wind or water. The disease is thus acute in specific centres and that in patches in affected fields.

The roots of the parasite entwine those of the host and feed on them. The host plant soon gets low in vitality and dies soon or later. Even if it drags on its existence, it bears little or no seed. When the striga seeds germinate in large numbers around a clump of ragi, the effect is so serious that the host will have a faded look before the striga plants shoot above ground.

Though the striga seed does not germinate without the host plant, the grown-up plant will, once it is started, continue to live independently of the host. In the Kar ragi area, I have seen green and flourishing plants long after the ragi had all been harvested. Green striga plants are often found around the dead clumps of ragi. How far the parasite is affected in its further growth in the absence of the host and whether it will bear and mature seeds as usual—are questions that require further examination.

Area affected and extent of damage.

Striga is found almost on the whole of the jola area. It is kept down by assiduous weeding and gets opportunities to multiply itself whenever the land is indifferently cultivated or weeding cannot be given frequently on account of weather conditions. It suddenly shows itself to an alarming extent in the next jola season. The damage in bad cases goes even up to 50 per cent. It also attacks the late or hingar jola, but rarely lives to develop and mature its seed. The collective damage to jola is hard to estimate, but it may not be far wrong if it is put down at 3 per cent.

It has poor chances to spread in the Kar ragi area as the land will have been ploughed before the seeds get ripe.

The chief victim to it is the late sown ragi especially in the semi-malnad where on account of peculiarly moist weather conditions, persistent weedings are not possible. The lethargy of the cultivators and the scarcity of labour give it a further premium. It has thus gone on increasing day by day and hundreds of acres have almost been abandoned from cultivation or produce little or nothing. Its pernicious effects are acutely felt within a radius of 20 miles from Shimoga where there are even spots of its special activity. The damage is more than 50 per cent or 75 per cent in specially affected fields and it hardly pays to cultivate ragi on such areas. Nearly 1,000 acres must be under its baneful influence. Fortunately it is not universal on ragi as it is on jola though its severity is more apparent on ragi in specialised centres. Thus the proportion of damage to the total crop in the State is infinitesimally small.

Remedies.

Deep ploughing is suggested as one of the ready remedies, but the fact is not borne out of experience. Black cotton soil is ploughed more than half a foot deep for cotton and when jola succeeds cotton, striga springs up as though from the bowels of the soil.

Rotation with horsegram or any other non-host crop is a surer remedy: but one year's rotation will not be of much avail. At least three intervening crops will be necessary to effect a material reduction in the number of striga plants.

Constant and frequent weedings will keep it in check as most of the plants are removed before they fruit. Many a time the incessant rain and the slushy condition of the soil do not admit of weeding and the striga plants continue on unhindered. Again striga plants do not all show themselves at the same time, and a good number of weedings will have to be given to remove all of them. The cultivator may not afford so many weedings and it may not either pay him to invest in these operations.

To plough down the striga before it ripens its seeds is probably the best and the surest remedy. That is why it cannot assert itself in the Kar ragi area where ploughing is done in

September before the striga has seeded. This procedure is not possible in hain area as land will have become too dry for ploughing before ragi matures. Here ragi should be sown early in the season to induce the germination of the striga. Then striga, ragi and all must be unmercifully ploughed down and incorporated into the soil. A late crop like horsegram may be sown in the land if wanted. If this method is adopted successively for a few years striga can be undoubtedly kept down, if not, destroyed wholesale.

Spraying for Leaf Disease in Coffee.

(Hemilcia Vastatrix in Coffee.)

DR. COLEMAN WRITES TO US:—

THE question of spraying for various pests and diseases of coffee has been discussed at various times more especially in the Planters' Chronicle. Most of the data so far available has been with reference to spraying for Green Bug (*Cocus viridis*) and Black Rot (*Corticium koleroga*) and it is, I think, generally admitted that where these are present in a bad form spraying is well worth while. With regard to spraying for Leaf Disease (*Hemilcia vastatrix*) we have comparatively little data.

Mr. H. Kerr of Kothencool Estate, Santaveri, has for several years been carrying on spraying work against Leaf Disease on a large scale. He has very kindly furnished the figures in tabular form with regard to his work which I think will be of great interest to many members of the Union. The table is appended. It may be noted that while a certain amount of spraying was done in 1917 it is only from 1918 on, that a large proportion of the Estate was sprayed. Mr. Kerr considers, and I think rightly, that it is only on the results of the past three seasons that the effects of spraying can be judged.

With regard to his results Mr. Kerr writes as follows:— "Herewith the details of my spraying. The yields under spraying

work out at an average of a little more than 29 tons. As you will note the crops have been fairly even since spraying was taken up: previously they were quite the reverse. To get an average for comparison with unsprayed areas one must take the results of the previous four years which total 70 tons or an average of 17½ tons. This shows an average excess of 11½ tons per year but this has to be discounted a little as the year 1918 which shows 37 tons would most likely in any case have been a big one. Still taking this into consideration there is a considerable increase in crop and as the manure has been rather less than in the previous years, I do not see how to account for it except through the spraying.

The whole thing however is full of contradictions; for instance this year the crop was extremely heavy in some places both sprayed and unsprayed and they both looked equally well; however in the case of the latter spraying had been done on it last year.

My experience is, spraying certainly helps to ripen crop and keep on the leaves and makes the trees crop under fairly heavy shade but it is no use doing a 'dud' tree. I am afraid we are getting a vast quantity of these now and the men will not dig them out."

The above remarks are very interesting, and I am sure a further account of results obtained by Mr. Kerr will be looked forward to with great interest.

Kothencool Crops, Sprayed against Unsprayed.

Year.	1912	1913	1914	1915	1916	1917	1918	1919	1920	
Total acreage	95	95	95	95	95	95	95	95	95	
Sprayed	...	...	...	...	...	20	78¾	59¾	52¼	
Unsprayed	...	...	...	...	...	75	16¼	35¼	42¾	
Quantity of manure per acre ...	30/6	45/7	30/6	22/4	26/2	17/4	19	25	...	
Cost of spraying	...	...	...	...	...	19	?	19/11	26	
Total Bushels	6948	1146	6031	1201	5708	821	6750	4035	5750	
Outturn tons	33¾	5¾	30	6	29¼	4¾	37	20¾	30½	Estimated.
Bushels green per ton	206	...	201	...	194	172	182	194	188	Estimate ; calculated on two previous years' average.

Actual Cost of Spraying 20 Acres. 6 x 6

135 coolies spraying at Rs. 5	...	42	3	0
31 mixing at Rs. 5	...	9	11	0
135 women carrying at Rs. 3	...	25	5	0
Maistry 31 days at Rs. 5	...	9	11	0
Commission on coolies	...	8	9	0
	...	95	7	0
4¾ cwt. sulphate at Rs. 60	...	255	0	0
5 cwt. lime including tins	...	11	6	0
Rail on above	...	8	13	0
Carting materials to Estate	...	10	0	0
	...	380	10	0

This works out at about Rs. 19 per acre, out of which Rs. 4-11-0 is labour, materials Rs. 14-5-0.

Crop sold by bushel dry.

Crop sold by bushel dry.

33 acres not manured.

No value put on cost of spraying as I was experimenting with various strengths.

Crop not yet sold. Cost of spraying too high ; I was not in the country.

From our Co-operators,

being brief statements of the results of actual tests conducted by the farmers of the State of the various recommendations of the department, with their opinions and suggestions thereon.

I.

Use of Paddy Manure Mixture* in Goribidnur Taluk.

A.

I bought four bags of paddy manure from the Agricultural Inspector for use on my paddy land for the *Vaisakhi* crop of paddy. I got ready 25 guntas of land in the usual way, applied the quantity of manure mixed with five cart-loads of cattle manure and I sowed 20 seers of sprouted seed in the puddle. Twenty-five days after sowing and again after an interval of 30 days, I had the field weeded. The crop came up very well, towards the end of the season channel water failed and I had to irrigate sparingly from well water. The produce from this field measured 12 pallas and 16 seers or at the rate of 19½ pallas per acre. If the water-supply had not failed, I estimate the yield should have been 3¾ pallas more per acre. However, last year, on the same field, I got only 7½ pallas although I had manured with the same five cart-loads of cattle manure along with green leaves worth Rs. 22-8-0, and though the water-supply was abundant, my impression is that, with three bags of this manure applied per acre, we shall be able to get very good yields without the trouble and expense of using bulky organic manures like cattle or leaf manures.—*By Mr. A. Gundu Rao, Landholder, Doddakurugod, Goribidnur Taluk.*

B.

I bought two bags of paddy manure to be used on my paddy lands at Kadaranahalli for the last *Vaisakhi* crop of paddy. I prepared 35 guntas of land, trampled in ten head-loads of green leaf manure and spread these two bags of paddy manure. I sprouted 36 seers of *kapilasanna* paddy and sowed it broadcast.

* A mixture of oil-cake and bonemeal; the quantity recommended cost Rs. 17 per acre last year.—Ed.

Twenty-five days after sowing and again after an interval of 30 days the field was weeded. The crop came up very well and the water-supply was also normal. The crop was harvested and the produce measured 18 pallas and 50 seers or at the rate of 21½ pallas per acre.

In the last year on the same field I used 8 cart loads of cattle manure and six head-loads of green leaf manure and the produce was only 16 pallas.—*By Mr. Papayya, Patel, Kadaranahalli, Goribidnur.*

II

Banku Paddy in the Goribidnur Taluk.

During the year 1916.

I was supplied by the Agricultural Inspector four seers of Banku Paddy with instructions that the paddy should be transplanted and should be grown in the *Karthika* when, I was given to understand, the crop will come to maturity in four months.

I have since been continuing the cultivation for the last 3 years.

Second Year's Experience.

I prepared four guntas for nursery bed and sowed 36 seers sprouted seed. Two acres of land were got ready for transplanting. This land was manured with green leaf manure. (*Tangadi, Ugani* and *Hongay*, 300 head-loads costing Rs. 25.) When the nursery was 20 days old the seedlings were removed and transplanted in singles on this area on one and the same day. Twenty days after transplantation, the crop was weeded, the field was watered regularly, the crop matured in four and half months after transplanting. The yield amounted to 37½ pallas, or at the rate of 18¾ pallas per acre. After the crop was removed, the land was sown with jola, wheat and bengalgram.

Third Year.

Eight guntas of land was prepared as nursery bed manured with 16 cart-loads of cattle manure. Sixty-four seers of seeds were sown. Four acres of land were got ready for transplanting.

400 head-loads of leaf manure valued at Rs. 25 were trampled in, and when the seedlings were 20 days old. were transplanted in singles. Considerable seedlings were left over and this was distributed to some of the neighbouring ryots. The field was weeded once 20 days after transplanting. The crop again matured in four and half months after transplanting: the yield this year amounted to 75 pallas or 18¾ pallas per acre. After this ragi and jola were grown.—*By Mr. A. Venkate Gowda of Karikalhalli, Goribiduur Taluk.*

III.

Red Mauritius Sugar-cane.

Three thousand sets of Red Mauritius Sugar-cane Sets were offered for planting on my lands last year. The sets were planted in pits 3 feet apart each way. The canes were well formed and they grew up to a good height. The canes appeared very hard. The ryots were inclined to think that the canes were not juicy and that they would not yield as much as the local variety. Added to this, it was believed that the local cane crushing mills would not quite suit to mill these canes. Having all these apparent defects in this variety of cane, the ryots became much discontented: as such the Departmental assistance was sought to get rid of all the standing crops by selling them as cane. It so happened that none of the cultivators bought them with the result that there was no other go but to mill them. The Agricultural Inspector and the fieldmen were visiting the cane-field now and then and they were saying that there was no fear of the canes not yielding good jaggery and that it was worth our while to mill them. A fieldman was present while the milling was going on; contrary to our expectations, we found that the cane was capable of yielding good hard jaggery. Rupees 150 were spent on the cultivation of the crop from start to finish and the area of the field was about half an acre. The total yield of jaggery was 125 maunds. On seeing this, some more cultivators of the village offered to plant the canes. Some of them have been supplied with sugar-cane sets for planting this year.—*By Mr. Veeregowda, Patel of Doddahejjaji.*

IV.

Nahan Cane Crushing Mill.

A jaggery boiling demonstration was conducted in the village of Bidlur by the Agricultural Department. The newly designed mill called the Nahan Foundry Mill, the use of which was demonstrated in the village, was one of considerable improvement over the local mills in a number of respects, and they are:—

(1) The loosening and tightening of rollers are very easy and when once they are adjusted, frequent manipulation of the part is unnecessary unlike the country mills.

(2) They are easily worked by ordinary bullocks.

(3) The crushing capacity is quite high. It looks as though the begasse that comes out of the mill is so dry that it could be readily used for feeding the jaggery boiling furnace.

The mill was so satisfactory that I was tempted to buy it. Eventually I applied for its being given to me on Hire Purchase System. The mill is now owned by me.—*By Mr. B. Mallappa, Patel of Bidlur.*

V.

Transplanting of Banku Paddy.

On 10th June 1919, 25 seers of Banku paddy were supplied to me with instructions that a nursery should be prepared and the seedlings raised should be transplanted. Accordingly the nursery was prepared and the seedlings were transplanted over an area of about three and half acres. The crop appeared at the first sight very poor, but eventually the seedlings tillered very freely. The paddy areas adjoining this plot were infected with some disease, but this plot was free from it. About 150 seers of seed paddy would have been required if the whole area were sown broadcast. The seed paddy was selling then at five seers per rupee. At this rate 150 seers of paddy would have cost Rs. 30 at the least. There was thus a clear saving in the cost of seed. Secondly the crop was free from disease that damaged

the other crops, which yielded only five or six pallas of paddy per acre; whereas the Banku paddy plot yielded at about 20 pallas of paddy per acre.—*By Rev. Father Faisander of Doraisanipalya, Bangalore Taluk.*

VI.

The Kolar Mission Plough.

I found the Kolar Mission plough do excellent work on my fields. I think every ryot will bear testimony. I have found that it cuts and inverts the soil, thereby finishing the cutting up of the soil in one operation. This has enabled me to plough both my dry and wet lands very much quicker than with the country ploughs. I have found this plough does at least double the amount of work of the ordinary ploughs, while as regards quality, there is practically no comparison.

The wearing part is the share. I found that on my soils a share lasts for eight acres. By replacing these shares whenever necessary, it looks as if the plough will last many years.

The price of Rs. 25 however is very high, probably due to the war conditions. (The present price is Rs. 21.—Ed.) But if we look at the work turned out we can't consider this too high. I may add that I do not find it necessary to use large sized bullocks. A pair worth Rs. 150 is found sufficient.—*By Mr. Chenné Gowda, Representative Assembly Member, and Zemindar, Maddur.*

VII.

The Meston Plough.

For those who think that the improved plough cannot be used except by those who keep large bullocks, I think the Meston ought to suit very well. I have been using it on both dry and wet land with only an ordinary pair of bullocks. For wet land work, *i.e.*, for ploughing in puddle, I find it exceedingly useful. I do not think ryots who have once experienced the working of this plough would think of using a country plough again. The plough is not costly either, as one can be got for Rs. 9 and the share replaced also at very little cost.—*By Mr. M. C. Lingè Gowda, District Board Member, Maddur.*

NOTES AND COMMENTS.

By the Editor.

The Hebbal Agricultural School.

Our readers will be interested to know that the course of instruction in our local Agricultural School has been converted into a three years' course. The qualification for admission has also likewise been increased, so that only those that have passed at least the School Final Examination will be admitted. The syllabus and other allied matters are also being suitably revised.

The old two years' course has been given up ; but simultaneously with the new course arrangements are under weigh to start a two years' vernacular course.

The Revision of the Agricultural Courses in the Coimbatore Agricultural College.

We understand that the Agricultural Courses in the Coimbatore Agricultural College are soon to be entirely recast. The chief feature is to be the affiliation of the College to the Madras University, and the institution of a course leading up to a degree ; a full three years' course is to be prescribed, none but those who have passed the intermediate examination of the University will be admitted and the prospects in the agricultural service for the men who pass out are to be greatly improved. There is further to be a separate two years' course for men who, whatever their attainment in education may be, are anxious to undergo an agricultural training. We have not seen the details of the new scheme ; it is obvious however that the scheme is designed with a view to attract young men of abilities to the college as in the case of the other professional colleges ; this is a great point, for otherwise the material for building up a body of highly trained men will never be forthcoming and we shall ever have to depend upon imported talent. The scheme at the same time does not shut the door against men with a lower grade of school education. We trust however that the larger and more urgent need

of instructing the actual cultivator and his sons will not be lost sight of, and that suitable institutions such as special schools, will be also organised simultaneously, as is being done in our own State.

Groundnut (Arachis Hypogea) as a Rotation Crop with Ragi.

On the Hebbal Farm the system of growing ragi after ragi has been compared with rotating ragi with groundnut; the results are so distinctly in favour of the latter that it may safely be recommended for all soils similar to those we have in Hebbal. The following are the figures:—

	Yield of Ragi in lbs. per acre.				
	1915-16.	1916-17.	1917-18.	1918-19.	1919-20.
Ragi after ragi ...	636	1312	1894	750	1039
Ragi after groundnut ...	496	1628	2380	1348	1394

We trust this practice will be widely taken up. Ragi is the most extensively grown dry crop in the State and groundnut though occupying at present only a very subordinate position as regards area under cultivation is extending rapidly. The results quoted above should be therefore very useful under these conditions. The fact that the results have been fairly uniform in trials which have been repeated for five years with the painstaking care that one is accustomed to look for in the Hebbal Experiments should make them particularly reliable.

The Rhinoceros Beetle.

What shall we do to keep off this terrible pest of the cocoanut tree? We dig out manure pits and rubbish heaps and destroy the larvæ. We hire men to go round every morning armed with a piece of stout wire with a barb at one end, hunt for the beetle in the plants and harpoon them out. We grow *Euphorbia tirucalli*, plantains, and various other plants in close association with the cocoanut plants in the belief that the beetles do not go near and hurt these plants; we leave castor oil-cake, salt, sour vinegar, asafætida, fermenting castor cake mash close to the tree in the belief that some will repel the beetles and that others will

attract them so that they find their death in the pot containing the mess. Nothing seems to be as satisfactory a remedy as we should like. The list we thought was long enough ; but we have come across still another *viz.*, the use of "Marothi" oil-cake (*Hydnocarpus Whitiani*). We read in page 85 of the Year Book of the Madras Department of Agriculture for 1919 that, in the extensive cocoanut plantation of Mr. Baker at Kumarakum in Travancore. lumps of this cake are placed in the young leaf axil of the plants and that the cake keeps off the beetle.

We invite our cocoanut growers to give this remedy a trial.

The Indian Sugar Committee in Mysore.

The Indian Sugar Committee visited the State in the month of March. Dr. Leslie C. Coleman was co-opted as a member during the Committee's sittings in Mysore. The following gentlemen were examined as witnesses :—Mr. V. Rangasami Iyengar, Director of Industries in Mysore ; Mr. B. K. Garudachar, Merchant, and Hon. President, Bangalore City Municipality ; Sir Alfred Chatterton, and Mr. N. Krishna Iyengar, B.A., Jodidar of Ooragahalli, were examined in Bangalore ; Mr. B. Venkata Rao, Senior Assistant Botanist at the Hebbal Farm ; Mr. Cromwell of the Goribidnur Sugar Works at Goribidnur ; Mr. G. S. Forbes, Chief Electrical Engineer at Sivasamudram ; Rao Bahadur K. Krishnaiyengar, Chief Engineer, Cauvery Valley Irrigation, and Ourselves at Krishnaraja Sagara ; Mr. K. S. Kadambi, Chief Engineer ; Dr. Leslie C. Coleman, Director of Agriculture ; Dr. B. Narasimhaiyengar, Agricultural Chemist, and Mr. D.G. Ramachandra Rao, Assistant Director of Agriculture at the Babboor Farm in the Marikanavé area. At Goribidnur the Committee also examined three of the large sugar-cane growers *viz.*, Messrs. Lakshman Reddi, Chikkegowda of Sravandahalli and Bapi Reddi of Kurgod, all of whom possess experience of the use of oil engines, pumps and power sugar-cane crushers.

It will be seen that the Committee traversed many areas of importance from their special point of view and examined a very large number of witnesses. Their visits to the Hebbal and Babboor Farms should have been of great interest, as the former, in addition to its being the sugar-cane breeding station of the

State can claim to be one of the earliest stations in India to start accurate experiments in cane growing and manufacture : on the Babboor farm cane is grown on a large area and milling was in progress at the time of the visit : in view of the possibilities of the Marikanavé area for the development of the sugar industry this visit should have been of much interest to the Committee. We have no doubt that the Committee should have been much impressed with "go ahead" Mysore. Elsewhere in this number of the Journal appears a resumé of the written evidence of some of the witnesses.

The Rationale of Green Manuring.

The use of green manures is one of the oldest of manuring methods known to the cultivator : nevertheless we seem to be yet far from being able to explain its action under varying conditions. In South India the commonest practice is its use in paddy fields where it is trampled into the puddle whether it was grown on the field itself or brought from outside. It was believed more or less generally that the beneficial effect was due to the actual nitrogenous matter added as plant food in the shape of the green material. The work of Dr. Harrison however showed that a large proportion of the nitrogen in the manure escaped in the shape of gas and was thus lost to the crop, and that the beneficial result was due to the greater æration brought about by the green manure—a result which it may be possible to produce by other and perhaps less expensive methods.

It was thought that if the green manure could be incorporated into the dry soil and allowed time to decompose thoroughly before puddling the field for paddy, the nitrogen in the manure could be saved for the paddy crop. Mr. Parnell at Coimbatore tried to test this point ; he mixed the green manure with the soil in February and by August when the manure had well decomposed the field was puddled and paddy sown alongside of a paddy plot where the green manure was ploughed into the puddle fresh in the usual way. He found that the latter gave a higher yield, showing apparently that either it was not altogether a question of the saving of the nitrogen or that this was not the correct method of saving the nitrogen.

While this is the state of affairs regarding the action of the green manure under the conditions of paddy cultivation there seems to be the same uncertainty as to its action in 'dry' cultivation. At Pusa green manure (sannhemp) was cut and allowed to ferment in separate vats and then applied to the soil, the crop being tobacco. The results were positive. In the Hebbal Farm where experiments have been carried on for a number of years in manuring ragi with green manure leguminous crops grown in the field itself and ploughed in, results have been inconclusive and somewhat inexplicable. Experiments on the other hand where ragi has followed a legume grown as a rotation crop have shown that the ragi is distinctly benefited although the legume was allowed to mature fully, a good crop taken, even the haulms and leaves removed from the field and little left in the soil which could be said to have supplied any additional plant food to the ragi crop except the roots of the green manure crop. Soil analysis intended to trace the fate of the green manure crops can also be quoted, with about the same result as regards their inconclusiveness. All these point to the necessity of extensive and long continued research in the field and the laboratory even in a subject like this about which one believed that everything was as clear as daylight.

* * * *

A Milk Supply Company for Madras City.

The great industrial awakening in India that is one of the most important features of the past year in this country has not concerned itself very much with agriculture, or with rather agriculture in its somewhat restricted sense of crop raising and its allied branches. No doubt a few of the companies launched so far have for their object the cultivation of tea, rubber or other plantation products, or the exploitation of the forest wealth; a few again are such as to stimulate the production of raw produce like the great cotton mills, the oil pressing concerns, the sugar companies, tobacco companies and so on. But companies directly concerned with some branch or other of agriculture have been few or none at all. We have not heard of companies devoted to the acquisition and development of large landed pro-

perties ; the provision of large irrigation supplies, the cultivation of economic crops on a large scale, of the rearing of cattle, sheep or horses, of the supply of dairy products, of the raising of fruit and the supply of fresh and preserved fruit and fruit products and so on. It is with special pleasure therefore and with not a little pride, because South India is evidently setting an example to the rest of the country in these matters, that we notice the formation of the City Hygienic Milk Supply Co., Ltd., in Madras. The company has for its object the starting of a large dairy business with a view to supplying pure wholesome milk to the City of Madras, where the present supply is, as in the case of all the other cities and towns, most unsatisfactory in every respect. The establishment of a large dairy farm out in the country about 30 miles from the City, the stocking of the farm with animals of the reputed milk breeds of India, the transport of milk by rail or motor, central city depôts, refrigeration, hygienic handling and vending, all form part of the scheme. The capital of the Company is Rs. 5 lakhs, which though somewhat modest in these days when company promoters think only in lakhs and crores, is yet sufficiently ample for ordinary needs.

The Company deserves every support from the public, for it is almost the only way in which the problem of the milk supply to Indian cities, which has been studied, investigated and reported upon by a number of people, can be solved. Milk must be produced outside of city limits and however much the public would like to buy milk not out of the milkman's pail but right out of the teats of the cow milked at the customer's door, it must be prepared to see the cow disappear altogether from within city limits, for the demands of city sanitation will gradually bring this about if not the impossibility of making cow-keeping within the city a paying proposition. And when milk has to be brought from outside it will be impossible to expect any but a large concern handling very large quantities of milk to deal with and vend it in a sanitary manner without making the milk too costly. Small but increasing quantities of milk from outstations even now

do come into the cities for sale, but the manner in which they are handled and vended is such that the less said about it the better. The small farmer in the villages who now holds aloof or dictates impossible terms to the small collector of milk in the villages will adopt a more reasonable attitude regarding steady supply, purity of milk, time of delivery, prices and so on when he realises that he is no longer the master of the situation. The steady custom which a large buyer will afford will be the reward for his compliance and will gradually induce him to keep better stock and to bestow more attention upon them. It may be anticipated that should the company run its own dairy farms on a large and satisfactory scale, it will result in the improvement of the whole business of dairy farming permanently among the surrounding villages.

We have much pleasure in commending the company to the support of the public and we wish it a prosperous career.

Should the Cattle Trade be controlled?

A feature of the discussions at the several district conferences held in the current year has been a representation that the price of draft cattle in the State has become prohibitively high, that the ordinary cultivator is finding it impossible to purchase bullocks of the size needed for his tillage operations, that the best cattle are being bought up by outsiders and are sent out of the country and that some action in the nature of a restriction of the export of cattle is urgently called for, if we are to see that the cultivation of the land does not suffer or the breed of our cattle does not degenerate. More than once similar discussions have taken place in Bombay and Madras regarding the distinctive breeds of note of those presidencies, namely, the Gujerat and Sindhi and the Nellore breeds of cattle, and recently in the legislative councils of both these provinces the restriction of exports was urged with much vehemence. It is evident that if the non-official members voice the feeling in the country correctly there is considerable restlessness in this matter and in all likelihood we shall hear more of it as the days go by.

As far as the Mysore State is concerned the matter is of the

very highest importance. Mysore is one of the important cattle breeding areas of India and the type of cattle bred is held in great repute. Practically the whole of the South Indian market for high class draft cattle is supplied, while for the heavy black cotton soils surrounding Mysore on the north and north-east it is a general favourite. At the numerous annual cattle fairs and weekly markets great numbers of excellent cattle both young weaned calves for rearing and grown-up animals are brought for sale. Traders from far and near visit these fairs regularly. Prices rule high almost invariably. In fact cattle breeding in the State is such an important source of income to the farmer that measures likely to affect it prejudicially deserve very careful consideration.

It is contended that the country is being depleted of its cattle slowly on account of the present unlimited export. Official statistics do not however support this contention. Both in Madras and Bombay the Government published figures to show that the export was insignificant compared with the annual production. In Mysore we have no figures to show the extent of the export, but the cattle population as disclosed by the quinquennial cattle census shows an increase of bulls and bullocks during the last 15 years as may be seen from the following table :—

Year.	Bulls and Bullocks.
1900	1,489,814
1905	1,468,083
1910	1,631,871
1915	1,683,239

It is however not possible to make much use of these figures in this connection as the latest figures are five years old and as the special cause *viz.*, 'high prices' has operated only during this period. We are therefore not in a position to tell exactly what result the export highly stimulated by good prices has had. It is just possible that the high prices have been too great a temptation to the ryot and that oblivions of his true interests the ryot has parted with more cattle than may be compatible with the needs of the State. Such a thing has happened before now with the food grains of the State and it is just possible it has happened

in the case of the cattle also. Personally we should hesitate to believe this has happened, for more than once we have come across much dissatisfaction at several cattle fairs that the foreign merchants did not turn up and that the trade was slack.

It has also been urged that the animals which are being exported are the best in the State and that the local breed is therefore beginning to deteriorate. That just at present no deterioration is perceptible is a point that everybody can concede; but whether any is likely to take place is however a point on which there may be difference of opinion. In any case neither the depletion of the number of cattle nor the deterioration can be proved just yet: all that can be conceded is that there may arise a possibility remote though it may be of such a danger, to prevent which it is most important that we should take measures betimes.

It should be remembered that the high price which outside customers are able to pay constitutes a most important stimulus to the industry. It is the steady foreign demand that has been the main cause which has brought about the highly specialised types of horses, beef and dairy cattle, sheep and pigs in the countries of Europe, notably in England, Jersey and Belgium, and has stimulated them not only to steadily maintain the high level but strive to improve them further. This point was brought out forcibly by Dr. Coleman in his article in Live-stock improvement in this journal, *vide* page 3 Vol. 1, No. 3. Restricting or controlling the export in any way will give a serious blow to the industry not to speak of the difficulty of exercising such control in practice or of the abuse it is likely to lead to.

For to restrict export is to remove the stimulus; on the other hand we want all the stimulus that can possibly be provided to induce ryots to go in for breeding more and better stock. The remedy lies, we think, in assisting the farmer to respond more effectively to this stimulus. It should be possible for every village to own one or two good breeding bulls and for every ryot to keep one or more good cows. Crop raising and cattle rearing are not mutually exclusive, and without going to foreign countries for examples, we can see in our best breeding

tract *viz.*, Nagamangala that the bulk of the splendid calves are produced by the small farmer who keeps only one or two cows. At present the keeping of good breeding bulls in villages is by no means common and even in good breeding tracts ryots go long distances to have their cows served. The concessions granted by Government to ryots desirous of keeping stud bulls are exceedingly liberal and it has been a puzzle to us that these have not been taken advantage of. If we can see to it that every large village has such a bull, we can then arrange that many of these at least keep the very best bulls available in the State. Our idea is that a stud herd of about 50 (or even a smaller number for a beginning) bulls, being the best in the State should be kept on a Government farm from which they should be sold to villagers at cost price on condition that they should be used as stud bulls and that they should not be sold as long as they are fit : the stud farm should be on the lookout for the best stock in the country from which the farm should replenish its stock frequently so that there may be the full number always available. This would ensure that the best stock remain in the State for breeding purposes so that there can be no question of deterioration ; and the increased number of breeding bulls in the country side will mean a larger production of first class stock. The high prices if they should continue will stimulate production, encourage the ryot to bestow greater care on his cattle and pave the way for other improvements.

PERSONAL NOTES.

We are glad to welcome Mr. W. Davison, B.S.A., the newly appointed Live-stock Expert to the Department.

* * * *

A Government scholarship has been awarded to Mr. N. S. Rangaswamy, one of our members and a passed student of the Hebbal Agricultural School, to study advanced agriculture at the Pusa Research Institute, for two years.

* * * *

Mr. K. Kunhi Kannan, Senior Assistant Entomologist, to whom a scholarship for foreign study was granted, left for Bombay *en route* to Egypt on 29th February 1920. Mr. Kunhi Kannan is to spend sometime in Egypt, Italy, and England before proceeding to New York.

* * * *

Dr. Leslie C. Coleman, Director of Agriculture, and Mr. M. G. Singrachar, Agricultural Engineer, were deputed by the Government to proceed to Nagpur to witness the Tractor trials held there in the month of February. The Agricultural Engineer also visited the Kirlosker Plough Factory in Satara during his return journey to Bangalore.

* * * *

Mr. K. Bhima Bao, B.A., F.C.S., who had gone to Pusa for a course of study of the manufacture of Indigo returned after completing his course of studies. Mr. Bhima Rao has summarised the salient points of the cultivation of the Indigo and its manufacture in Behar in a note which was published in the Agricultural Calendar of the Department for the current year.

SELECTIONS.

I

Prickly-pear as Fodder.

The combined experience at Dhond, at Poona, and in the Ahmednagar and Poona districts leads to the following statement as to the best and safest methods for using Prickly-pear as a food for the maintenance of famine cattle and as a nucleus in the maintenance of *mhot* cattle.

1. *Value of Prickly-pear as Food.*—Prickly-pear properly prepared, in the dry weather, is about two-thirds the value of ordinary green jowari fodder, and can be used safely in replacement of a corresponding amount of the latter.

2. *Burning of Prickly-pear for use as Fodder.*—There are two methods which have proved successful in preparing the fodder. In both cases an intense hot flame is necessary, and one free from smoke. The fruits should be removed before the pear is burned.

(*a*) *Method with Blow Lamps.*—Cut the pear in branches from two to four feet long. Hang it on stout iron hooks about five feet from the ground on a cross beam of wood by one of the joints. leaves downward, so that the lowest part will be clear of the ground. Begin burning from the lowest leaf. The heat from the lower thorns burning will flare up. All the thorns will not be burnt up thoroughly in this way, and the whole branch will flare up. The whole will have to be gone over with the lamp, working upward, to burn what is not properly burnt. Then it will have to be looked over once more to get rid of any stray thorns which have escaped notice.

This is the best way of burning the Prickly-pear, but lamps are now difficult to get and very expensive, while they are liable to get out of order quickly under village conditions.

(*b*) *Method of Lohar's Forge.*—An ordinary Lohar's forge can be used almost equally well for burning prickly-pear. In this case the fire is fixed, and the pear in suitable-sized branches about two feet long, which should not be too straggling, is held with the Lohar's tongs in a sloping position over the flame of a well-blown-up forge. The thorns will catch fire, and those on the upper part will flare

up as when the lamp is used. Then the branch is turned over and the other side burnt in a similar manner. If any thorns remain, as for example at the place where it was held by the tongs, the branch must be held over the fire till all are burnt.

As blow lamps are almost unobtainable, the Lohar's forge is probably the best method for general use this year. It should be fixed up, if possible, in a shed protected from the wind.

3. *Preparation of burnt Prickly-pear.*—When the pear is burnt it should be rubbed over with a stiff brush or a piece of gunny bag to remove any fine thorns and hairs remaining. Then it should be cut up either with choppers on a log of wood, or with a chaff-cutting machine. When animals are first fed with it, the cutting should be to very small pieces but, later, the pieces may be up to one or two inches square.

4. *Systems of feeding Prickly-pear.*—The animals should be gradually accustomed to the food, otherwise it may lead to purging or to tympanitis, as in the case of other green fodders.

The following is a good method of using the prickly-pear :—

(*a*) When the animals are new to this fodder, the following ration should be used :—Two pounds prickly-pear with ¾ pound cotton seed, linseed meal, or any oil-cake. This should be given three times a day (making six pounds prickly-pear and two pounds of the other food per day), for the first week. This required to be supplemented with three pounds of dried grass or kadbi per day.

(*b*) After the first week, the prickly-pear ration may be increased to from eighteen to thirty pounds per day, according to the size of the bullock or cow, and to the succulence of the prickly-pear. Along with this, at least half a pound of dry food, preferably cotton seed or oil-cake, should be mixed and given every day. A little grazing or, in its absence, about three pounds of dried grass, or kadbi should be given if possible, as an addition to the above ration. It is advisable to give a little salt. Animals in cattle camps should have some exercise, and be watered twice a day.

Mr. Norton has found at Dhond that after cattle have been feeding on the above ration for some time, they will thrive on prickly-pear alone.

5. Demonstration.—It is advised that anyone wishing to use this method of feeding should visit a centre where the use of prickly-

pear is in operation. At present it can be seen and shown at the following places :—

(*a*) The Poona Agricultural College Dairy near Mariai's Temple, Kirkee.

(*b*) Rev. A. Norton's Farm, Dhond, District Poona.

(*c*) Ahmednagar (under the control of the Collectors.)

No doubt more centres will shortly be inaugurated, and information as to these can be obtained from the Collectors of each district.

6. *Treatment of Animals becoming sick.*—In the event of any animal suffering from tympanitis, purging, or indigestion from this food a dose of sweet oil (from half a bottle to a bottle) should be given, and another diet substituted for the time being. In cases of severe tympanitis, the Veterinary Department will be very pleased to give every assistance.

If any animal appears distressed, or any salivation noticed, the tongue and mouth should be examined, and if any thorns are found they should be removed.—Leaflet issued by the Bombay Department of Agriculture.

II.

Variation and Correlation in Wheat, with Special Reference to Weight of Seed Planted.

During the four years 1914—1917 the authors made a study of variation and correlation in wheat, and arrived at the following conclusions :—

The magnitude of the means for any of the characters studied varied in response to environmental conditions. Lower yields of straw resulted from a reduction in number, total length, or average length of culms per plant, and lower yields of grain from a reduction in the number of kernels. When the kernels developed normally, lower yield was accompanied by a higher average weight per kernel.

In general, a reduction in the magnitude of the means is accompanied by less variability. A number of exceptions to this general tendency occurred.

Correlation between weight of seed sown and resultant plant characters at maturity is not high in any instance and may be so

modified by environmental conditions that the relation may be slight or obliterated entirely.

Correlation between plant characters is modified by environment, the degree of modification from this cause varying with the characters considered.

An increased yield of kernels is very closely accompanied by an increase in number of kernels, number of culms, and total length of spikes; and somewhat less closely accompanied by an increase in average weight of kernels per plant, average height of culms, and average length of spikes. A larger number of culms per plant is accompanied by a greater total length of spikes, but not by a greater average length of spikes.

Average weight of kernels is substantially, fairly and consistently correlated with yield of kernels, and, subject to radical change due to environment, moderately correlated with average length of spikes. With number of kernels the correlation is rather low but always consistent. Average weight of kernels is practically independent of average length of spikes.

There is a distinct tendency for greater average height of culms to be accompanied by greater average length of spikes, number of kernels, and higher yield of kernels. Average length of spikes is moderately correlated with average weight of kernels three years out of four. The correlation between average height of culms and number of culms is always low.

There is a distinct tendency for plants of varying height at second leaf to maintain the same relative heights at six weeks, but there is lesser tendency for this relation to be maintained at maturity.

From this study, conclusive evidence is given that for the conditions under which the work was done, environment reduced radically or obliterated entirely the correlation between weight of seed sown and plant characters among which is yield.

This information answers, in part at least, the questions raised in the introduction to this article regarding the rôle of weather and soil in comparison of heavy and light seeds for planting. If these results were applicable to the wheat crop in general during the four year period, it is clear that on soils of moderately high productivity with favourable weather conditions heavy kernels as compared with light kernels used for planting may be expected to give very moderate or no increase in yield.

In the study of the interrelation of plant characters, a substantial and fairly consistent correlation was found between yield of kernels and average weight of kernels, average height of culms, and a somewhat higher correlation with number of culms. Between average height of culms and average weight of kernels there is a moderately high correlation each year, except in 1915, when the co-efficient is very low.

If these relations held for the wheat crop during the four year period, separating from the crop each year seed of higher average weight would be selecting seed from plants which had a decided tendency towards higher yield, and with the exception of the year 1915, from plants which were taller and at the same time higher yielding. In 1915, there was practically no relation between average weight of kernels and average height of culms, and separating the larger seeds from this crop would be selecting seeds from both high and low yielding plants.

The tendency of the tallest plants and the plants having the greatest number of culms to be the highest yielders is a valuable index in making individual plant selections from mixed populations. —Journal of Agricultural Reserch, Washington D.C., Vol XIV, No. 9.

III.

The Dwarf Coconut.

Will P. Handover.

The increasing rise in the price of copra having given renewed activity to coconut planting in this country it is important that some facts of this interesting variety of coconut should be put on record.

Description.—The dwarf coconut known in this country as "nyiur gading" is remarkable for its early fruiting, palms only 10 feet high bearing abundant fruits touching the ground. The young palm grown under good conditions starts to flower in its third year and produces ripe fruit in about nine months from the appearance of the flower spike. The initial flower spikes contain only male flowers, but other spikes occurring in rapid succession, are larger and bear an increasing number of female flowers also, a spike from

a six-year-old tree being counted with 200 young female flowers, whilst trusses of fruit from similar trees have been found with as many as 55 ripe nuts.

The dwarf coconut is generally of a bright yellow colour and Winstedt in his quotations from Malayan Folk-lore speaks of "nyiur gading," the golden coconut only to be found in princes' gardens.

There is besides, a distinct brick-red variety, also a green variety, and a number of intermediate colours which might be ranged as ivory yellow (hence "gading") golden yellow, orange, brick-red, green bronze, and deep green. The flower spikes, leaf bases, and leaf ribs, correspond in colour with the fruit, giving the compact trees a very handsome appearance. Again there are semi-tall trees of these different colours, which are later coming into bearing, have slightly larger nuts, and are less prolific than the true dwarf.

The dwarf yellow strain appears as the most prolific whilst the other varieties vary proportionately in their productiveness and also in the shape and size of the nut and are evidently the outcome of cross fertilization from original types or "mutants."

The different varieties are distinguished amongst the Malays and Javanese under particular names, such as nyiur (klapa) gading, k. merah (or rajapj) k. kapak, k. pisang, k. puyok, k. baba, k. sepang and k. nipah.

A full grown leaf of the "nyiur gading" measures only 12 feet from base to tip, whilst an average ripe nut 22½ in. x 24 in. in circumference, and the palm stem 24 inches in girth, the nut has an average amount of fibre, a thin shell, and proportionately with the big nut, a good thickness of white kernel.

This "meat" is said by the Malays to be richer in oil and sweeter in taste than that of the big coconut and it is therefore very popular with them for domestic purposes.

History.—In spite of diligent enquiry it has not been possible for the writer to find out the definite origin of this dwarf nut, but it seems first to have occurred as a "sport" or "mutant" probably in Java. Trees, thirty years old or so, occur in different parts of the peninsula and many of these still bear abundantly.

In 1912, 500 acres were planted with these dwarf nuts at Sungei Nipah Estate, on the coast between Port Dickson and Sepand

Point and this is probably the only estate of dwarf coconuts in this world. The seed nuts for this were obtained from trees then about 12 years old grown by the Malays on the "bendangs" of the Krian rice district, who are reported to have got their original seed, individually at a dollar each from ships arriving at Penang probably from Java.

From reliable reports from India it appears that this dwarf form is practically unknown, either in Malabar, the Madras Presidency, or Ceylon, though isolated groups as that of the "king coconuts" at Mount Lavinia doubtless occur.

Scattered trees also occur throughout Java and Sumatra, but not in any quantity, seed for planting having been sent to all the places named also to Manila, and to the northern and eastern States of the Malay Peninsula.

Growth.—Like all coconuts, this dwarf form appears to be exceedingly hardy, growing well either in white clay, red loam, or deep peat, in fact it seems to thrive in any situation where water is abundant, yet not stagnant, though it is evident that well drained alluvium suits it best.

In such a soil six-year old palms have been counted with 234 nuts on (excluding ovules) and the trees average 80 nuts a year.

The only figures available are those from Sungei Nipah where unfortunately, the young palms were allowed in the early days of the war to get choked by lallang during the third year, and although they have responded wonderfully to better treatment since, this set-back at so critical a period, will doubtless have its effect throughout the life of the trees. The Malays say "nyiur gadang suka perkawan" and palms near dwellings readily demonstrate how well it responds to good treatment.

Crop.—In the first year of production at Sungei Nipah the crop over 225 acres was 102,000 nuts whilst the second year it was 574,000 nuts and the third year it will probably be nearly a million, from which the writer considers an average yield for dwarf nuts may be predicted as follows:—

At the end of 4th year.—1st yielding year 10 nuts per tree.

5th	2nd	,,	30	,,
6th	3rd	,,	60	,,
7th	4th	,,	80	,,
8th	5th	,,	100	,,
9th	6th	,,	120	nuts per tree in full bearing.

These estimates in face of yields from individual trees will appear conservative but there are many points which have to be considered when dealing with average yields and no doubt under ideal conditions a much higher average could be obtained.

In making copra, it has been found that the nut from a young tree is smaller than that coming later, and its kernel likewise thinner whilst of course on heavy yielding trees the nuts are a little below the average, in size but 500 nuts to a picul of copra is a general average, which would be decreased somewhat later as more even nuts with thicker "meat" were obtained. With the leaf length only 12 feet it was found convenient to plant the palms 24 ft. x 20 ft. which gave 90 to the acre, a number yearly double to that required when planting big palms.

It will be evident therefore that with this planting we should get, say, in the fifth year of planting 90 x 30 nuts = 2,700 nuts per acre, 5 2/5 piculs copra per acre. Likewise, in the ninth year 90 x 120 = 10,800 nuts per acre, 21 3/5 piculs copra per acre. Comparing this with the big coconut which does not produce till after its fifth year but might be estimated as giving in its ninth year 45 trees at 40 nuts = 1,800 nuts per acre, 8 piculs of copra per acre. With the dwarf trees there is the great advantage of easy and rapid picking, and inspection for beetles and other pests, though of course in manufacture one has to handle almost 2½ times the number of nuts per picul of copra, but this is not of so great consequence when working with newly devised methods and machinery, dealing with large quantities.

The profit per acre from five-year old dwarf coconuts to-day can even stand comparison with that of rubber, and the man who is planting to-day has to consider markets five years ahead and might do worse than place confidence in the dwarf coconuts.—Agric. Bulletin, F. M. S. Vol. VII. No. 5.

IV.

The Development of Cane Planting by the East India Distilleries and Sugar Factories, Ltd.

BY

Messrs. Parry & Co.

(Managing Agents.)

The East India Distilleries and Sugar Factories, Ltd., may be said to be the pioneers of the cane sugar industry in the Madras Presidency and some brief account of their progress and experience is worthy of record, explaining as it does some of the reasons why central cane factories in India are not always successful, and showing in a general way some of the difficulties to be expected when cultivating cane on a large scale.

A successful cane sugar industry requires large tracts of land within easy reach of a central factory, it being of first importance that cane once cut should pass through the mills within 24 hours of harvesting.

The first problem therefore was to procure suitable lands adjacent to the Nellikuppam Factory and, following on that, sufficient labour to cultivate them.

Here was presented an initial difficulty which at one time seemed insurmountable. For many years the local ryots had grown cane which they brought to the factory to be crushed; but this could never be relied upon as a regular source of supply for the reason that cane was only cultivated when it suited the ryot, *i.e.*, when the price of paddy and other crops offered less inducement than the price which the company could afford to pay for cane.

It was felt that development must lie in the direction of cane farms belonging to the company, but this was apparently an impossible proposition in view of the very high rents required for what are known as "wet" lands upon which only, it was believed, cane could be satisfactorily cultivated.

The very low price of sugar on account of cheap imports from Java and elsewhere made rigid economy a necessity, whilst the question of obtaining sufficient labour to cultivate the land was a further obstacle.

The introduction of the oil-engine for pumping purposes was the beginning of a new era, suggesting as it did the possibility of irrigating the large tracts of "dry" lands in the neighbourhood of the factory which had hitherto proved a comparatively poor source of income to the land owners. In the course of several years' experiments, certain tracts of these "dry" lands were found suitable for the cultivation of cane, and the company commenced to negotiate for leases with a view to expansion to the extent of the labour available.

Such negotiations were at first lengthy and arduous, but some 40 acres were eventually planted, and the problem of procuring a variety of cane suited to the extremely trying Indian climate next presented itself.

It was necessary to find a cane capable of withstanding the hot weather and dry winds of May and June, and equally capable of developing sufficient strength to stand up against the heavy downfall of rain generally experienced between October and December.

With the assistance of the Government Cane Breeding Station at Coimbatore many varieties were experimented with and it was eventually found that the Ashy and Red Mauritius canes would grow more or less satisfactorily, though the yield in tons per acre left very much to be desired in comparison with the crops grown in other countries.

It will thus be seen how handicapped the company was at the start. Land was difficu't to obtain, labour at the time of cultivation comparatively non-existent, and suitable canes had to be discovered, the growth of which owing to climatic conditions was only about half the tonnage per acre accepted as necessary for economical development on a commercial scale.

However, having satisfied themselves that by patient negotiation land was procurable, the company's attention next turned to the question of seasoned canes, irrigation and artificial manuring. The sinking of wells and establishment of pumping stations were easy matters; and judicious manuring demonstrated that reasonably satisfactory crops could be produced if experienced attenion was given to the selection of seedlings.

To arrive at this point required much patient investigation, and having surmounted to a great extent the initial difficulties the labour problem had to be considered.

There is plenty of labour to be obtained in the district but as the preparation of land must take place simultaneously with the harvesting of the groundnut crop—more easy and congenial work—some method of mechanical cultivation was essential. To deal mechanically with small plots of "wet" land surrounded with bunds and irrigation channels was not practicable, but having proved that cane could be grown on the large tracts of "dry" land, a Fowler's double engine steam tackle was purchased for ploughing, trenching and cultivating.

This after a year's experience proved a decided success, doing better, quicker and cheaper work on a large scale than had formerly been possible by hand labour even on a very small scale under constant and thorough supervision.

The company was now in a position to go ahead with development and commenced to extend their operations to the limit of their powers of mechanical cultivation, *i.e.*, 7,800 acres.

With this extension the improvement and capacity of the factory mills became essential, and the general activity shown in all directions brought the ryots to realize that the cultivation of cane for the central factory was a steady source of income worthy of attention.

Encouragement to extend the acreage planted by ryots was given in the shape of advances and seedlings, whilst much was done to assist them by the sale of oil-engines and pumps on easy payment terms. As a result, the acreage under cane extended very nearly to the limit of the factory's capacity and the question of transport at the harvest time became a problem.

Carts had hitherto been obtainable for the company's crops but were now to a great extent requisitioned by the ryots themselves. In addition, it was found that to convey loaded carts of cane across trenched fields to the roads was a tedious business and heartbreaking to cattle. The company therefore laid down a light portable tramway across their larger farms, with trucks which could be easily propelled by hand labour. This tramway brings the cane to a point on the main road where bandies can be loaded for a comparatively short journey to the factory, and it is intended later to carry the line up to the South Indian Railway and despatch the cane on special trains, thus releasing more carts for work in other directions.

During all the above operations the company was endeavouring to secure a cane of better class than the Red Mauritius variety which, while appearing to be immune from any serious disease, is not of a very high sugar content.

The following table gives particulars of various canes experimented with, and it will be noticed that the most promising of all is Fiji B:—

Name of varieties	Per cent Brix	Purity	Tans of cane per acre
Fiji B.	16·76	83·01	47·78
Kallakurichi ...	12·46	56·80	42·85
Big Tanna	15·97	78·89	40·96
D. 131	15·77	77·43	37·94
Purple Mauritius ...	15·50	79·49	37·55
131	14·72	79·28	37·51
Ashy Mauritius ...	16·71	84·55	36·64
55	15·18	75·72	36·07
B. 3412	17·08	79·77	34·31
D. 74	14·86	77·05	34·01
B. 147	16·01	81·27	32·00
D. 625	15·45	75·41	28·40
Ashy Mauritius ...	16·78	82·88	25·89
Red Mauritius ...	16·98	79·57	22·97
Java 247	14·46	76·54	22·60
Ashy Mauritius ...	15·31	76·35	20·86
Java 247	14·70	73·28	20·24

It must, however, be recollected that the very good results shown have been obtained on specially selected experimental plots, and that on an average nothing like the tonnage indicated can as yet be expected.

Upto date the average figure has been about 25 tons per acre but by careful manuring it is hoped to bring the figure to 30 tons, which is probably the limit to be obtained in the Madras climate.

This figure is naturally dependent on the rainfall, and the crops harvested in 1919 owing to continued drought during the preceding year were very much below the tonnage hitherto experienced. As a result, the planting by ryots this year has shown a considerable falling off and the company therefore now proposes to make arrangements to increase its own farm acreage to make itself less dependent than hitherto on supplies from outside sources.

We give below some notes supplied by the Manager of the Nellikuppam Factory which are of interest :—

"I am of the opinion that cane Fiji B, a few sets of which we got from Coimbatore about 4 or 5 years ago, and the area of which we have gradually extended, is likely to prove a much more useful cane than Red Mauritius. It is a short, thick cane of very erect growth and not liable to be blown over by high winds. It has a comparatively high sugar content and crushes splendidly in the mills. The rind is sufficiently hard to defend it from jackal attacks, and during the four or five years we have grown it, although it has been tried under all sorts of varied conditions, it has shown no signs of disease but on the contrary has distinctly improved in appearance and growth. I think the fact that the local ryots have taken spontaneously to this cane as they never did to any other variety, argues well for its popularity and success in the future.

"With the irrigation facilities we have, our canes generally start very well indeed and give a good and regular stand and very few blanks have to be filled up, although we maintain small nurseries for this purpose. I have shown our young plantations about a month or two old to experienced planters from Mauritius and they seem to think that our canes make a much better and quicker start than they do in that island. Unfortunately, on occasions we have long spells of very dry weather accompanied by hot winds. During such times, even with ample well irrigation, the cane does not appear to grow at all, and I consider this climatic difficulty is a very serious one and accounts to a great extent for the lower yields obtained in India than in countries favoured with a more humid climate. Further we have a period in November and December of excessively heavy rain amounting sometimes to 35 inches in a month, which also does damage to the crop by laying it. The juice of such cane has always a very low purity but no practical means has been found of obviating this difficulty. The introduction of a shorter and thicker cane is the only way we see out of it."—*From the Agricultural Journal of India*.

V.

The Availability of Nitrogen in Nitrate of Soda, Ammonium Sulphate, Dried Blood and Farm Manures.

The problem of the availability of nitrogenous fertilisers has occupied the attention of the principal European experiment stations for about thirty years. About twenty years ago this question began to be studied in America as well and the results obtained there confirmed, on the whole, those of European workers. The authors describe a series of investigations lasting over twenty years (1898 to 1917) made with five-year rotations grown in galvanised iron cylinders set in the earth. The sub-soil used was gravelly sand and the top soil loam. The basic fertiliser was made up of ground limestone, 640 lb. per acre of superphosphate and 320 lb. per acre of potassium chloride. The first rotation, begun in 1898, included (1) maize, (2) oats or millet, (3) oats or maize, (4) wheat, and (5) timothy. The second rotation, begun in 1903, included the same crops except that the oats might eventually be replaced by maize. The third and fourth rotations were similar to the second except that, in the third, rye and oats were grown together instead of wheat. The nitrogenous fertilisers used were farm manure at the rate of 16 tons per acre, of sodium nitrate 320 lb. per acre, of ammonium sulphate and dried blood each equivalent to 320 lb. of sodium nitrate per acre.

Results:—The amount of sodium nitrate used gave better results than the equivalent amount of ammonium sulphate or dried blood. During the first ten years these two fertilisers gave results almost equal to those obtained with sodium nitrate, but after this period increased the yield less and less. The average amount of nitrogen recovered in the crops during the twenty years was 62·42 per cent with sodium nitrate, 47·48 per cent with ammonium sulphate, 38·69 per cent with dried blood and 32·69 per cent with cow manure. Cow manure applied at the rate of 16 tons per acre gave yields slightly superior to those obtained with sodium nitrate, but the difference was not sufficiently great to justify the higher cost of applying nitrogen in this form.

Conclusions.—Sodium nitrate as the sole source of nitrogen can, if suitably supplied, maintain high yields for a long time. Nitrogen supplied in this form is more efficacious than an equivalent amount of nitrogen supplied in an ammoniacal or organic form. The effect

of sodium nitrate is to produce larger crops per unit of nitrogen. At the same time the crops leave in the soil a larger quantity of crop residues, so that, when calcium carbonate is added to dissolve them a sufficient supply of organic matter is obtained to keep the soil in good physical condition.—*J. G. Lipman and A. W. Blair, in Soil Science, Vol. No. 4.*

VI.

The Selection of Rice by Pure Strains, in Java.

Results of series of experiments made between 1911—16, at the Buitenzorg Station and in other localities of Java, with the Kowel Glindorean, Rogol and Solo varieties of rice, in order to ascertain the true practical effect of selection by pure strains. The chief results obtained at Buitenzorg are given below :—

Kowel Variety.—Out of 34 pure strains of the first selection 15 gave in 1913–14 a yield higher than that of the original plants, five an equal and 14 a lower yield. In 1914–15 the cultural tests were limited to the four best lines of the 15 mentioned above, under the numbers 11, 13, 23, 34. Three of them, especially Nos. 13 and 34, retained their superiority, while No. 23 gave a lower yield than that of the original plants. In 1915–16 the two best lines (Nos. 13 and 34) also gave a negative result.

Glindorean Variety.—Out of 35 strains of the first selection, 12 yielded in the first year, more than the original plants, six as much and 17 less. The following year, more or less the same facts were noted as for the Kowel variety, and the superiority of the pure strains diminished rapidly afterwards.

Rogol Variety.—This is noteworthy for the positive results it gave the first year. Out of 61 strains, 53 were better than the original plants. But afterwards, as in the two previous varieties, the productivity of the best strains diminished rapidly, so much so that, the fourth year, only one strain (No. 43) retained its superiority.

Solo Variety.—There are two forms, Solo I and Solo II. The latter, with plumper seed, was discovered and isolated in 1913. Both varieties behave much in the same way as the Rogol variety.

Comparative cultural tests and selection tests made in two other localities, Nyandjoek and Sidoardjo, gave results agreeing fairly well with those of Buitenzorg, and like them, lead to the conclusion that selection of rice by pure strains according to the criteria observed in Europe and America is practically useless in Java.

According to the author, there are two reasons for this failure:—

(1) The large annual variations of the meteorological values, as a result of which the same strain may give good results one year and bad results the next. Thus the strain Caroline No. 2 was clearly superior to strain No. 5 in 1911-12, whilst in the following year the inverse took place. On the contrary in the ordinary population the various properties of the constituent strains tend to compensate themselves, so that the yield tends to remain more or less constant.

(2) The great variability of the soil, especially in the coastal zone, where the variability of the water-courses produces such an irregular mixture and distribution of the silt that uniform soil conditions can rarely be found, even over small areas. Thus, a pure strain produced and differentiated in a small area responds only to the exigencies of that area ; when spread over large areas and taken into soil conditions different from those of its place of origin, it soon loses its characters of productivity.

This observation suggests the interesting problem of mixtures to sow seeds, not of distinct pure strains but of a mixture of pure strains of the same or different varieties, so as to obtain an adaptability and elasticity equal to that of the ordinary plant populations and, at the same time, greater productivity, together with the progressive elimination of the strains of lesser value.

In 1915-16 the author carried out a series of experiments on these lines, using mixtures in different proportions of seed of (*a*) pure strains No. 12 and 28—35 of the Glindorean variety ; (*b*) the Glindorean and Mamas varieties ; (*c*) the Mamas and Pandan varieties ; (*d*) the Rogol, Pandan and Baok varieties.

During these experiments it was found that, according to the case, artificial mixtures gave results that were either superior or more or less equal, or inferior to those of the original populations or of the strains (or varieties) sown separately.

These contrasts can be explained by the fact that the mixed strains (or varieties) strongly influence each other both as to quantity or as to quality. These reciprocal influences sometimes give a sum of positive effects, at other times a sum of negative effects, whence the diversity of the results obtained.

The system of artificial seed mixtures is, therefore, sound. The question is, in each case, to choose a certain number of strains (or varieties) that do not give rise to a sum of negative effects and are capable of simultaneously providing that the " artificial population " formed by them will have the adaptability proper to " natural populations " which is necessary to maintain a fairly constant yield under very varying condition of soil and climate.—*L. Kock in Teysmannia, Year XXIX, Batavia, Java.*

Notification by the Director of Agriculture in Mysore.

OFFICE OF THE DIRECTOR OF AGRICULURE
IN MYSORE, BANGALORE.
March 25th, 1920.

Circular No. C. 641.

As requisitions for candidates to fill the posts of Managers of private estates are being received by the undersigned, the passed students of the Agricultural School desiring employment are requested to have their names registered in this office with details of the minimum emoluments and other conditions which would induce them to take up such service. The availability of these posts will from time to time be intimated to those whose names have been registered.

LESLIE C. COLEMAN,
Director of Agriculture.

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